SESSION 3: POLARIS REVIEW

MICHAEL KINGSTON
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PAME POLARIS DATA COLLECTION AND EVALUATION PROJECT

DRUMMOND FRASER

- POLARIS Project (CAN/IMO) – Approved by PAME November 2024.

- **KEY OBJECTIVES:**
  - To establish a Correspondence Group with relevant experts to identify what information is necessary to conduct a review of POLARIS (IMO MSC.1/Circ.1519);
  - To collect this information from operators with the assistance of Arctic States and Observer State administrations;
  - To evaluate the information collected to understand the effectiveness of POLARIS as an operational tool;
  - To identify any needs for refinement;
  - To complete a Summary Report.

- First Correspondence Group meeting occurred January 15 2025.

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ORIGINS OF POLARIS

How to include something meaningful on the operational certificate that can be used by Administrations and Operators to evaluate the limitations for the ship operating in ice?

- Limiting Level Ice Thickness? – one condition!
- Polar Class / Ice Class Rule Descriptions? – usually "nominal"!
- Reference a system? – a few national systems, complicated wording [for the certificate]?

		Upper Limit of Ice Thickness (cm)								
		10	15	30	50	70	120	200	300	
Category	Ice Class	New	Young/ Grey	Young/ Grey White	Thin/ First Stage	Thin/ Second Stage	Medium	Thick	Old/ up to 3m	Old/ > 3m
A[1]	PC1									
	PC2									
	PC3									
	PC4									
	PC5									
B[1]	PC6									
	PC7									
C[2]	1B									
	1C									
	II									
	O/W									
Notes	1 - Equivalencies can be used as provided for in Part I-B									
	2 - Baltic ice classes shown can be substituted using the equivalencies provided in HELCOM 25/7									

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IACS Context

MSC93: Agreement that limitations for operating in ice to be included on the Certificate

MSC93 proposed initial guidance on limitations for operating in ice: MSC93/WP.7/Add1, Para 10:

in order to include the operational limitations in ice in the certificate, the group included a guidance in square brackets in part I-B of the draft Code, which will need to be further developed in conjunction with section 1.5 of part I-A, before the adoption of the Code (see part I-B, Additional guidance to chapter 1, Limiting ice capabilities for the Polar Ship Certificate). **In this context, the group noted that the observer from IACS stated that IACS would be willing to undertake further work on the guidance with the intention to submit a document to MSC 94. The group also noted that some interested delegations would cooperate with IACS on this necessary and urgent work.**

IACS Participants and structure of informal group

Develop Technical Content
↓
Develop Proposal
↓
Review and Validate

Technical Group

Informal CG

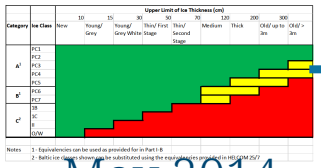
Technical Group: IACS, Canada, Denmark, Finland, Russia, Sweden

Informal Correspondence Group: email group consisting of volunteer members from MSC93 WG

Safer and Cleaner Shipping

POLARIS DEVELOPMENT

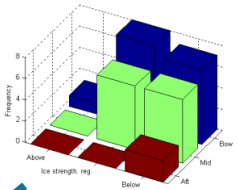
MSC.93 output



May 2014

MSC93 Limitations Concept / Table

Initial Level ice (100% concentration) limit

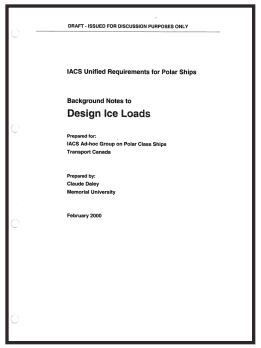


Canada experience Canadian Arctic Classes (CAC), Type Classes

Denmark experience: Baltic (FSICR) Classes in Arctic conditions

Finland / Sweden experience: Baltic (FSICR) Classes

Russia experience: RMRS Arctic (Arc) Categories, RMRS Ice Categories



IACS Unified Requirements for Polar Ships

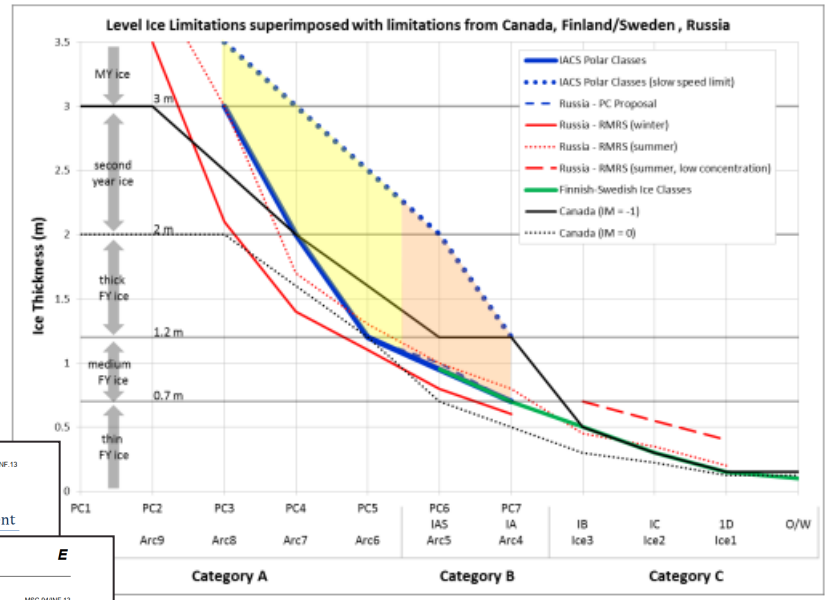
Background Notes to

Design Ice Loads

Prepared for:
IACS Ad-hoc Group on Polar Class Ships
Transport Canada

Prepared by:
Claude Daley
Memorial University

February 2000



Consolidated Level ice (100% concentration) limit

IACS Polar Classes Technical Background

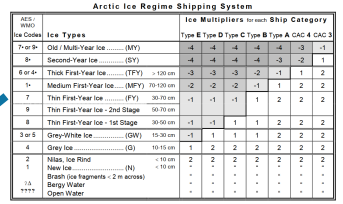


Table of Ice Multipliers for the Arctic Ice Regime Shipping System

AES / WMO Ice Codes	Ice Types		Ice Multipliers for each Ship Category Type E	Type D	Type C	Type B	Type A	CAC 4	CAC 3
7+ or 9+	Old / Multi-Year Ice ..... (MY)		-4	-4	-4	-4	-4	-3	-1
8+	Second-Year Ice ..... (SY)		-4	-4	-4	-4	-3	-2	1
6 or 4+	Thick First-Year Ice ..... (TFY)	> 120 cm	-3	-3	-3	-2	-1	1	2
1+	Medium First-Year Ice ..... (MFY)	70-120 cm	-2	-2	-2	-1	1	2	2
7	Thin First-Year Ice ..... (FY)	30-70 cm	-1	-1	-1	1	2	2	2
9	Thin First-Year Ice - 2nd Stage	50-70 cm							
8	Thin First-Year Ice - 1st Stage	30-50 cm	-1	-1	1	1	2	2	2
3 or 5	Grey-White Ice ..... (GW)	15-30 cm	-1	1	1	1	2	2	2
4	Grey Ice ..... (G)	10-15 cm	1	2	2	2	2	2	2
2	Nilas, Ice Rind	< 10 cm	2	2	2	2	2	2	2
1	New Ice ..... (N)	< 10 cm	-	-	-	-	-	-	-
	Brash (ice fragments < 2 m across)		-	-	-	-	-	-	-
	Bergy Water		-	-	-	-	-	-	-
	Open Water		-	-	-	-	-	-	-

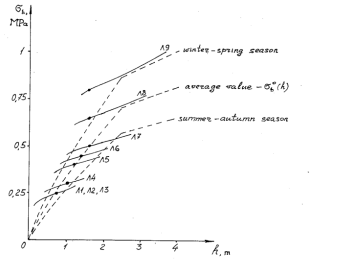
WMO Egg Code

Level ice (100% concentration) limit with adjusted ice type terminology

Denmark (Greenland) operational Feedback

Partial Ice Concentration Approach

Canada AIRSS



Canada AIRSS

Summer (decayed ice) Approach

Russia experience: RMRS Arctic (Arc) Classes, RMRS Ice Classes

Russia experience: NSRA requirements

July ICETECH'14

Canada AIRSS

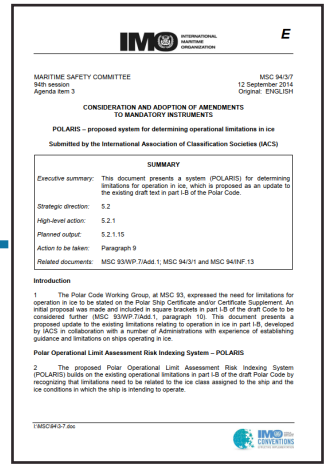
Escorted Operation Approach

Russia experience: RMRS Arctic (Arc) Classes, RMRS Ice Classes

Finland / Sweden experience: Baltic (FSICR) Classes

MSC 94/INF.13

Sept. 2014



MSC.94/3/7

POLARIS

Intersessional Correspondence Group

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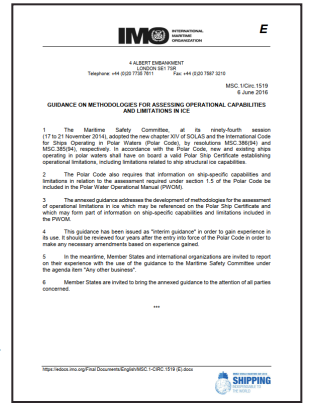
Report of Correspondence Group POLARIS (MSC 96)

MSC.1 Circ.1519

June 2016



POLARIS: PERSPECTIVES ON UPDATES

ROB HINDLEY

- Glacial Ice – Not covered at all in POLARIS, recognized as an issue during development, but no simple regulation to borrow from
- Ice Concentration – Formula basically gives linear risk with increased (total) ice concentration, it is most probably non linear, especially at low concentrations
- Icebreaker Escort – +10 to the RIO was a simplification, could be supported more and approach to considering brash / icebreaker track clarified
- Decayed Ice – When to apply, and where it applies. Especially for the Antarctic. RIVs are only adjusted for later stages of FY ice…but no adjustments for MY
- Slow Speed – Nominal 3 and 5 knot speeds pulled from Polar Class rules

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How ABS Uses POLARIS

- Beyond POLARIS being listed on a Polar Ship Certificate
- Answer the following questions:
  - What Ice Class is needed to go where and when or conversely what is the window of opportunity for a given route / destination for an existing ship?
    - ABS POLARIS maps for specific areas for each week of a year
  - Which ships are using the NWP and do voyage ice conditions match expectation from POLARIS?
    - Gives insights into how well POLARIS is working
  - What is the impact on shipping as ice conditions change?
    - Most recent work indicates that change / impact is significant
    - Leads to speculation regarding NWP broad viability

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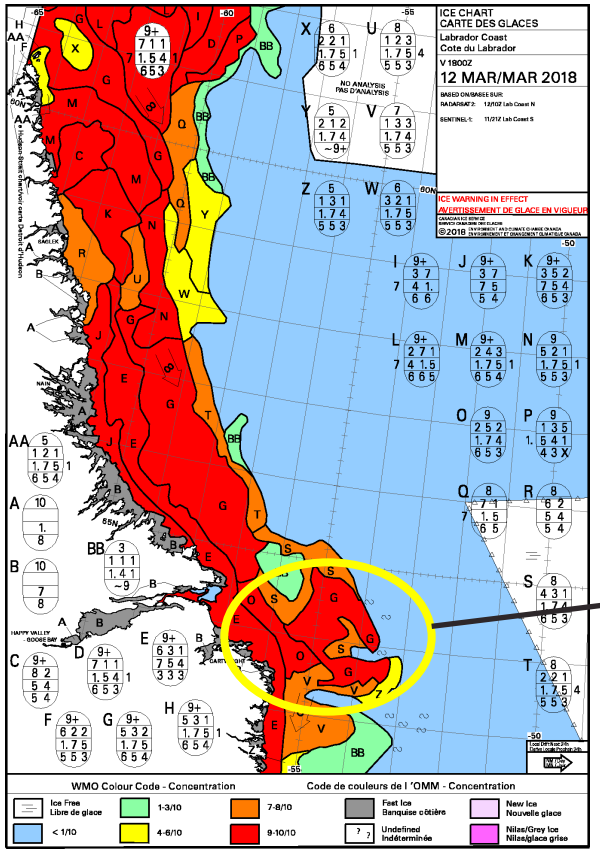
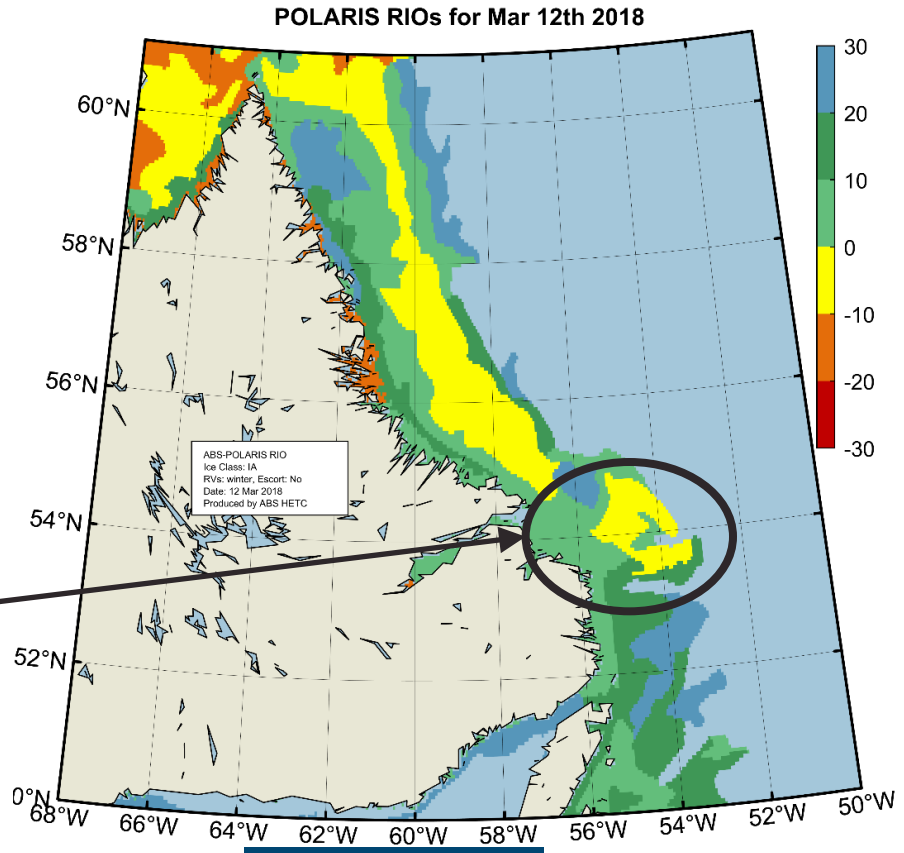
ABS POLARIS

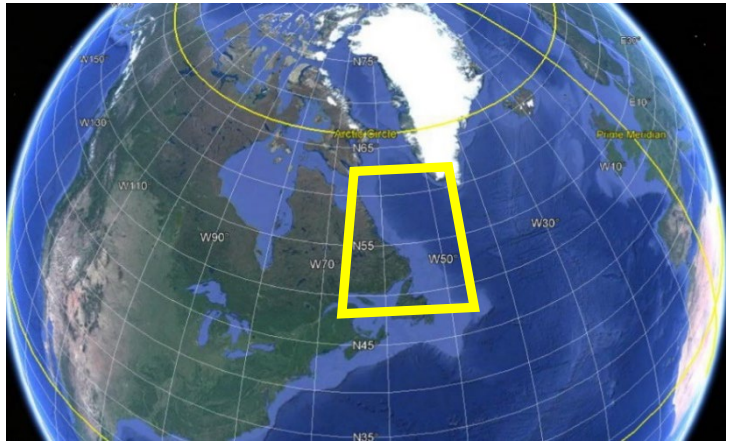
- Expands IMO POLARIS methodology from a single Risk Index Outcome value to compilation plot
- Uses published, publicly available ice charts (Arctic and Antarctic)

Canadian Ice Service



ABS-POLARIS





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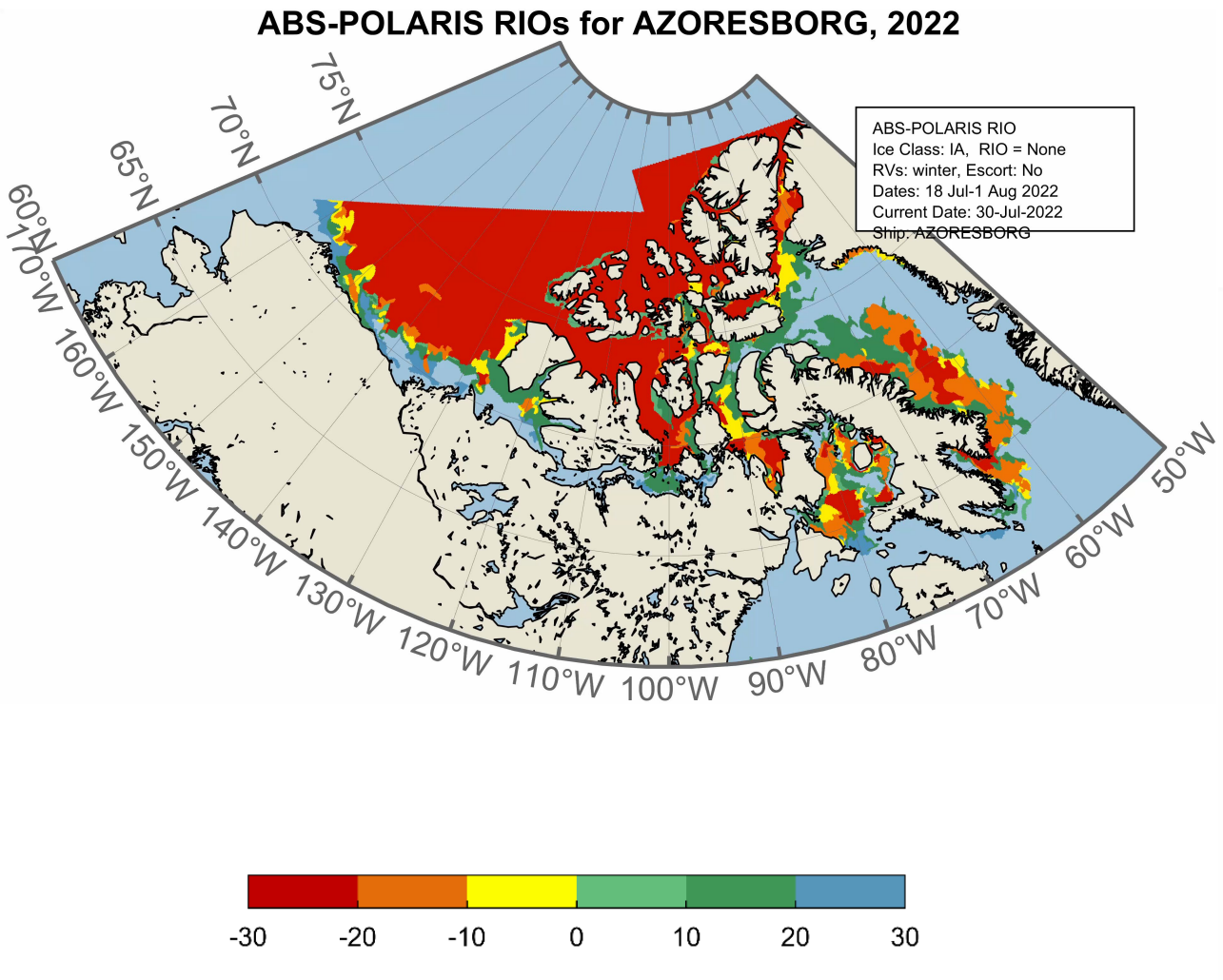
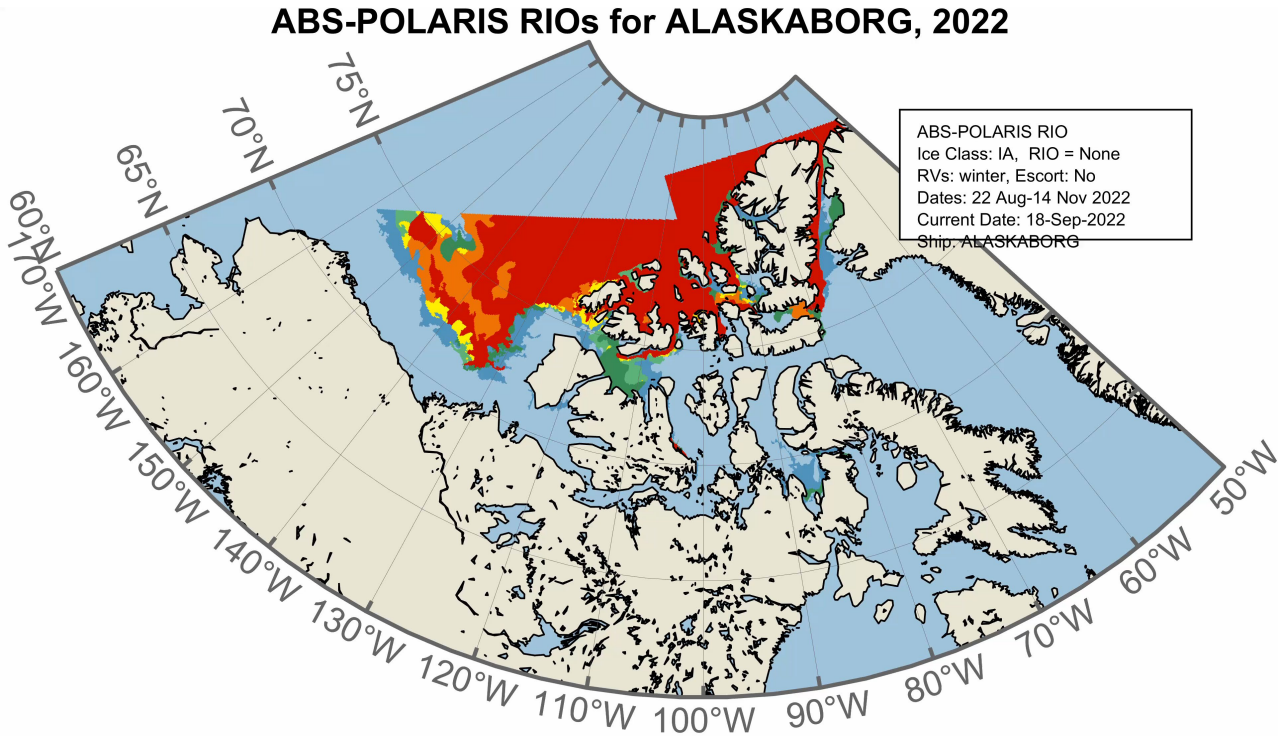
ABS POLARIS: 2022 ROYAL WAGENBORG





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IMPACT ON NWP DUE TO CHANGING ICE CONDITIONS

- Analyzed NWP Route 3 (broken into segments) RIO values for a PC7 during 2nd week of Oct
- Historically most challenging areas along Route 3 have been north of Baffin Island through Peel Sound, Franklin Strait and Victoria Strait (our segments 7 to 10)
- Ice conditions in these critical segments are showing a move from significantly negative RIOs to significantly positive RIOs, with variability apparent in the data
- Food for thought!

Segment #	POLARIS RIO Values									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	30	30	30	30	30	30	30	30	30	30
2	30	30	30	19	21	30	30	30	30	30
3	30	30	18	6	21	30	30	30	-8	30
4	18	20	-20	-22	15	25	22	-7	-8	21
5	-14	20	-25	-4	-10	5	-4	-13	30	23
6	-14	20	-20	7	-10	5	-4	-13	30	23
7	-14	20	-20	6	-10	5	20	-13	30	23
8	-25	23	30	4	5	22	20	18	30	28
9	-25	-25	21	11	5	13	11	15	30	30
10	-25	-25	30	-14	-20	13	11	30	30	30
11	-25	30	30	18	14	30	30	30	30	30
12	-25	30	30	15	20	30	30	30	30	30
13	-9	28	30	21	20	30	30	30	30	30
14	3	30	30	21	20	30	30	30	30	30
15	30	30	30	30	30	30	30	30	30	30
16	30	30	30	30	30	30	30	30	30	30
17	30	30	30	30	27	30	30	30	30	30
18	30	30	30	30	20	30	30	30	30	30
19	30	30	30	30	-20	30	30	30	30	30
20	30	18	30	30	-30	30	30	21	21	30
21	30	24	30	30	14	30	-13	21	30	30
22	30	22	30	30	15	30	-13	10	28	30
23	30	23	30	30	30	30	30	30	30	30
24	30	30	30	30	30	30	30	30	30	30
25	30	30	30	30	30	30	30	30	30	30
26	30	30	30	30	30	30	30	30	30	30
27	30	30	30	30	30	30	30	30	30	30

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POLARIS IMPLEMENTATION

MORTEN MEJLÆNDER-LARSEN

- DNV has issued more than 400 Polar Ship Certificates.
- Experience and feedback related to use of POLARIS is limited
- The user experience from operators are:
  - ✓ Used for planning and documentation, - when and where to operate
  - ✓ Requires basic knowledge about:
    - ✓ Ice in general
    - ✓ Limitations in the available data
    - ✓ The actual vessels limitations regarding speed, concentration, hull strength, ability to transit and size dependent factors.

- Before entering ice: - how to avoid ice
- When in ice: - how to find easiest way through

- <u>No systematic feedback is currently available</u>

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POLARIS IMPLEMENTATION

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Some questions to be addressed:

- Common understanding of ice concentration - low ice concentration is not the same as low risk
- Understanding the impact of vessel speed
- Need for better and standardization of ice information
- Training

The most important risk reducing measure is the knowledge transfer from ice captains and own experience at the bridge

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ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

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Arctic Shipping Pollution Prevention Regulations - North of 60° latitude

- Arctic Ice Regime Shipping S

$$IN = [C_a \, x \, IM_a] \quad + \quad [C_b \, x \, IM_b] \quad + ...$$

where
IN = Ice Numeral
C_a = Concentration in tenths of ice type "a"
IM_a = Ice Multiplier for ice type "a" and Ship Category (from the Table)

  - IN positive = go
  - IN negative = don't go

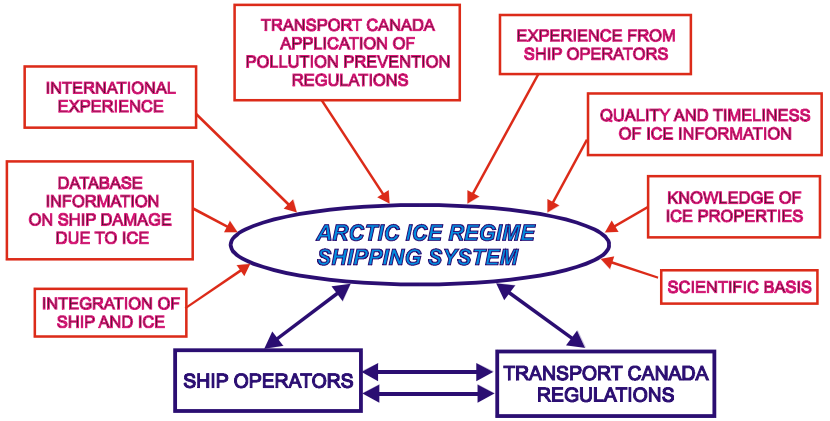
Table Of Ice Multipliers By Ship Category

AES / WMO Ice Codes	Ice Types		Ice Multipliers for each Ship Category: Type E	Type D	Type C	Type B	Type A	CAC 4	CAC 3
7• or 9•	Old / Multi-Year Ice..... (MY)		-4	-4	-4	-4	-4	-3	-1
8•	Second Year Ice..... (SY)		-4	-4	-4	-4	-3	-2	1
6 or 4•	Thick First Year Ice..... (TFY)	>120 cm	-3	-3	-3	-2	-1	1	2
1•	Medium First Year Ice..... (MFY)	70-120 cm	-2	-2	-2	-1	1	2	2
7	Thin First Year Ice..... (FY)	30-70 cm	-1	-1	-1	1	2	2	2
9	Thin First Year Ice - 2nd Stage	50-70 cm							
8	Thin First Year Ice - 1st Stage	30-50 cm	-1	-1	1	1	2	2	2
3 or 5	Grey-White Ice..... (GW)	15-30 cm	-1	1	1	1	2	2	2
4	Grey Ice..... (G)	10-15 cm	1	2	2	2	2	2	2
2	Nilas, Ice Rind	< 10 cm	2	2	2	2	2	2	2
1	New Ice..... (N)	< 10 cm	"	"	"	"	"	"	"
	Brash (ice fragments < 2 m across)		"	"	"	"	"	"	"
⇨Δ	Bergy Water		"	"	"	"	"	"	"
≡≡≡≡	Open Water		"	"	"	"	"	"	"

Notes: Decayed Ice: For the following ice types: MY, SY, TFY, and MFY that are 'decayed', add 1 to the Ice Multiplier.
Ridged Ice: For floes of ice that are over 3/10ths 'Ridged' and in an overall concentration that is greater than 6/10ths, subtract 1 from the Ice Multiplier.

- Context Diagram for the scientific basis for the Ice Regime System

The main factors driving the work



ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

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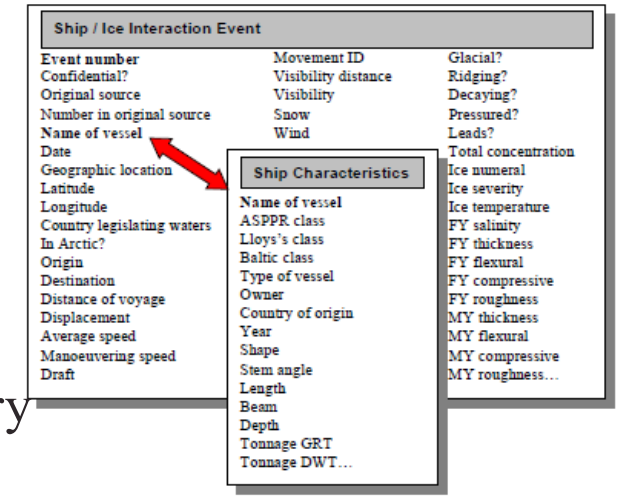
Canadian Ice Regime System Database*

- NRC developed a comprehensive Database with information on a large number of different ships and ship classes. The information included both damage and non-damage Events. The event is described as ship transit through a known ice regime and includes all relevant information about the transit, including the vessel characteristics, route, climate, ice conditions and resulting damage (or no damage). The database contained almost 2000 events, with about 250 damage events.

- Source of Information
  - NORDREG After Action Reports
  - Ship trial reports
  - Norland and AKAC damage reports
  - CIS (Canadian Ice Service) Ice Charts
  - Transit Reports from the shipping industry
  - Transportation Safety Board Reports
  - ISS Field Books (CIS Ice Service Specialists) and Canadian Coast Guard Commanding Officers
  - Information was reviewed and consulted with experienced Captains and operators; systematic feedback



* *Proceedings ISOPE'98, Vol. II, pp 586-591*

ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

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Analysis (examples)

- Damage events in ice regime with positive IN
- Non-damage events in ice regime with negative IN
- Observed versus Predicted ice conditions
- Bonus to experienced masters, operators and ice navigators
- Presence of Multi-year ice in the ice regime
- Summer conditions, ship under escort, visibility
- Looked at deficiencies of the system
- Pictorial Guide (TP 14044E)
- Understanding and Identifying Old Ice in Summer (CHC-TR-055)

Collaboration

- Canadian Shipping Industry (Fednav, NEAS, Desgagné, PetroNav, Woodward)
- Surveys and meetings with CCG Commanding Officers
- CIS ISS pre and post-Arctic meetings
- Many Workshops (Government, Shipping Industry, Oil&Gas Industry reps)
- International Meetings and workshops
- SAFEICE (Increasing the Safety of Icebound Shipping) Project – Canada, Finland, Sweden, Germany, Russia, Estonia, Japan,

DISCUSSION

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